Notice of Allowability	Application No.	Applicant(s)	
	10/049,650	KATES ET AL.	
	Examiner	Art Unit	
	Joseph P. Hirl	2129	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *March 10, 2005*.

2. ☒ The allowed claim(s) is/are *12-25*.

3. ☒ The drawings filed on *02 May 2005* are accepted by the Examiner.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

Examiner's Amendment/Reasons for Allowance

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

In the Claims

Claims 1-11 are cancelled. The following claims are new.

12. A method for training a neural network in order to identify a patient risk function such that the structure of the neural network is simplified, wherein the neural network includes

- an input layer having a plurality of input neurons that receive input data,
- at least one intermediate layer having a plurality of intermediate neurons,
- an output layer having a plurality of output neurons that provide output signals, wherein the output signals define the patient risk function following a first occurrence of a disease on the basis of given training data records including objectifiable and metrologically captured data relating to the medical condition of a patient, and
- a multiplicity of synapses, wherein each said synapse interconnects a first neuron of a first layer with a second neuron of a second layer, defining a data sending and processing direction from the input layer toward the output layer,

wherein the method comprises:

identifying and eliminating synapses of the multiplicity of synapses that have an influence on the curve of the risk function that is less than a predetermined significance, including

determining pre-change output signals of the neural network,

selecting first and second sending neurons that are connected to the same receiving neuron by respective first and second synapses,

assuming a correlation of response signals from said first and second sending neurons to the same receiving neuron,

interrupting the first synapse and adapting in its place the weight of the second synapse,

determining post-change output signals of the neural network,

comparing the post-change output signals with the pre-change output signals, and

eliminating the first synapse if the comparison result does not exceed a predetermined level.

13. The method of claim 12, wherein the first and second selected sending neurons are located on the same layer.

14. The method of claim 12, wherein interrupting the first synapse and adapting in its place the weight of the second synapse further includes adapting a value of a bias of the receiving neuron.

15. The method of claim 12, wherein identifying and eliminating synapses of the multiplicity of synapses that have an influence on the curve of the risk function that is less than a predetermined significance further includes

selecting a synapse, after determining the pre-change output signals of the neural network,

assuming that the selected synapse does not have a significant influence on the curve of the risk function,

interrupting the selected synapse, before determining the post-change output signals of the neural network and comparing the post-change output signals with the pre-change output signals, and

eliminating the selected synapse if the comparison result does not exceed the predetermined level.

16. The method of claim 15, further comprising

repeating the identifying and eliminating actions *n* times;

wherein comparing the post-change output signals with the pre-change output signals includes

comparing the post-change output signals with the pre-change output signals prior to performing the first identifying and eliminating actions, to provide a first comparison result; and

comparing the post-change output signals with the pre-change output signals after performing the *n*-1st identifying and eliminating actions, to provide a second comparison result;

wherein the comparison result is a cumulative comparison result including the first comparison result and the second comparison result.

17. The method of claim 12, further comprising

repeating the identifying and eliminating actions *n* times;

wherein comparing the post-change output signals with the pre-change output signals includes

comparing the post-change output signals with the pre-change output signals prior to performing the first identifying and eliminating actions, to provide a first comparison result; and

comparing the post-change output signals with the pre-change output signals after performing the *n*-1st identifying and eliminating actions, to provide a second comparison result;

wherein the comparison result is a cumulative comparison result including the first comparison result and the second comparison result.

18. The method of claim 12, further comprising calculating a value of a likelihood function for the neural network to represent an expected output of the neural network.

19. The method of claim 12, further comprising comparing structure variants of the neural network using a significance test.

20. The method of claim 19, wherein the structure variants of the neural network are compared using a CHI-SQUARED test.

21. The method of claim 19, wherein the structure variants of the neural network are compared using a BOOT-STRAPPING method.

22. The method of claim 19, further comprising:
calculating a value of a likelihood function for the neural network;

wherein comparing structure variants of the neural network includes calculating a ratio of values of the likelihood functions for the structure variants.

23. The method of claim 12, further comprising optimizing strengths of connections between connected pairs of the neurons according to a simplex method.

24. A method for training a neural network in order to identify a patient risk function such that the structure of the neural network is simplified, wherein the neural network includes

- an input layer having a plurality of input neurons that receive input data,
- at least one intermediate layer having a plurality of intermediate neurons,
- an output layer having a plurality of output neurons that provide output signals, wherein the output signals define the patient risk function following a first occurrence of a disease on the basis of given training data records including objectifiable and metrologically captured data relating to the medical condition of a patient, and
- a multiplicity of synapses, wherein each said synapse interconnects a first neuron of a first layer with a second neuron of a second layer, defining a data sending and processing direction from the input layer toward the output layer,

wherein the method comprises:

identifying and eliminating synapses of the multiplicity of synapses that have an influence on the curve of the risk function that is less than a predetermined significance, including

determining pre-change output signals of the neural network,

selecting a synapse,

assuming that the selected synapse does not have a significant influence on the curve of the risk function,

interrupting the selected synapse,

determining post-change output signals of the neural network,

comparing the post-change output signals with the pre-change output signals, and

eliminating the selected synapse if the comparison result does not exceed a predetermined level.

25. The method of claim 24, further comprising

repeating the identifying and eliminating actions n times;

wherein comparing the post-change output signals with the pre-change output signals includes

comparing the post-change output signals with the pre-change output signals prior to performing the first identifying and eliminating actions, to provide a first comparison result; and

comparing the post-change output signals with the pre-change output signals after performing the n-1st identifying and eliminating actions, to provide a second comparison result;

wherein the comparison result is a cumulative comparison result including the first comparison result and the second comparison result.

2. Authorization for this examiner's amendment was given in a telephone interview with Thomas Champagne on May 16, 2005.

Reasons for Allowance

3. Claims 12-25 are allowed.

4. The following is an examiner's statement of reasons for allowance:

The cited prior art taken alone or in combination fails to teach the claims invention of a method for training a neural network, to include pruning, to identify a patient risk function based on patient data and stipulated in the specification in paragraph 5.3 based on the survival function·S (t) wherein the task of the neural network is to model the curve of the risk function $\lambda(t)$ in the same way as a series expansion characterized by:

$$\lambda_0 \bullet \exp[\Sigma_0 B_0(t) \bullet A_0]$$

where :

λ_0 is a scaling factor,

A_0 represents parameters that are the response signals of the neurons N_0 of the output layer of the neural network, and

B_0 (t) represents a set of base functions of the series expansion that enable good approximation to the actual curve of the risk function.

The closest prior art (Mehrotra, Elements of Artificial Neural Networks, MIT Press, 1997) teaches training and pruning of neural networks. Mehrotra does not teach training a neural network to represent a series expansion wherein data representing such series expansion is formulated from patient data in an exponential summation format to include pruning represented by the singular act of neuron removal.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Correspondence Information

5. Any inquiry concerning this information or related to the subject disclosure should be directed to the Examiner, Joseph P. Hirl, whose telephone number is (571) 272-3685. The Examiner can be reached on Monday – Thursday from 6:00 a.m. to 4:30 p.m.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Anthony Knight can be reached at (571) 272-3687.
Any response to this office action should be mailed to:

Commissioner of Patents and Trademarks,

Washington, D. C. 20231;

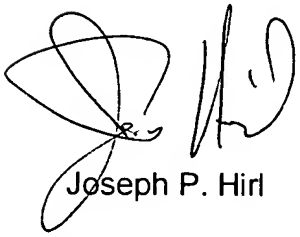
or faxed to:

(703) 872-9306 (for formal communications intended for entry);

or faxed to:

(571) 273-3685 (for informal or draft communications with notation of "Proposed" or "Draft" for the desk of the Examiner).

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have any questions on access to Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll free).



Joseph P. Hirl

May 18, 2005